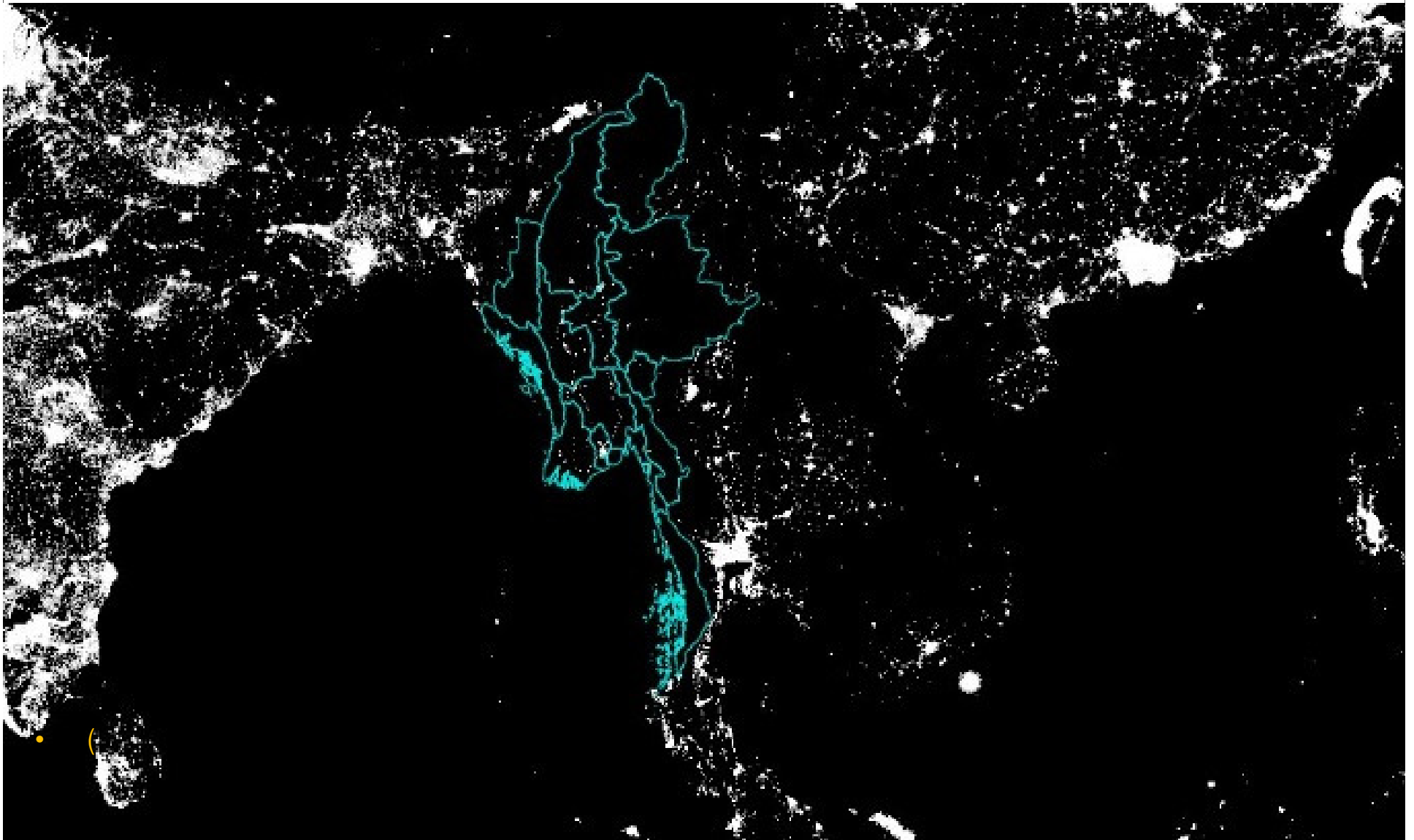


# IFC Energy Access – Myanmar

*(Lighting Myanmar)*

 **LIGHTING GLOBAL**  
Catalyzing markets for modern off-grid energy

AN INNOVATION OF  
**WORLD BANK GROUP**  
 **THE WORLD BANK** **IFC** International  
IBRD - IDA Finance Corporation



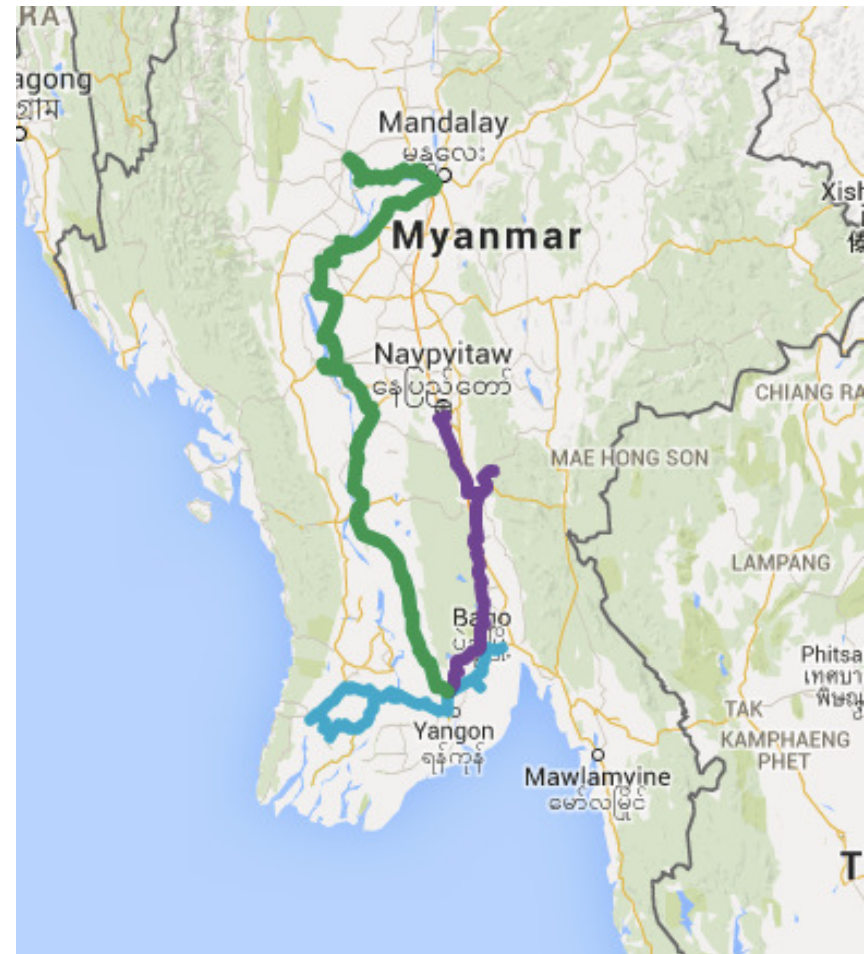
Part 1

# **Market Assessment**

# Summary | Purpose and Approach

**Purpose:** Initial assessment of potential and barriers for commercial off-grid market in Myanmar.

**Approach:** Secondary research, stakeholder interviews, and field visits.



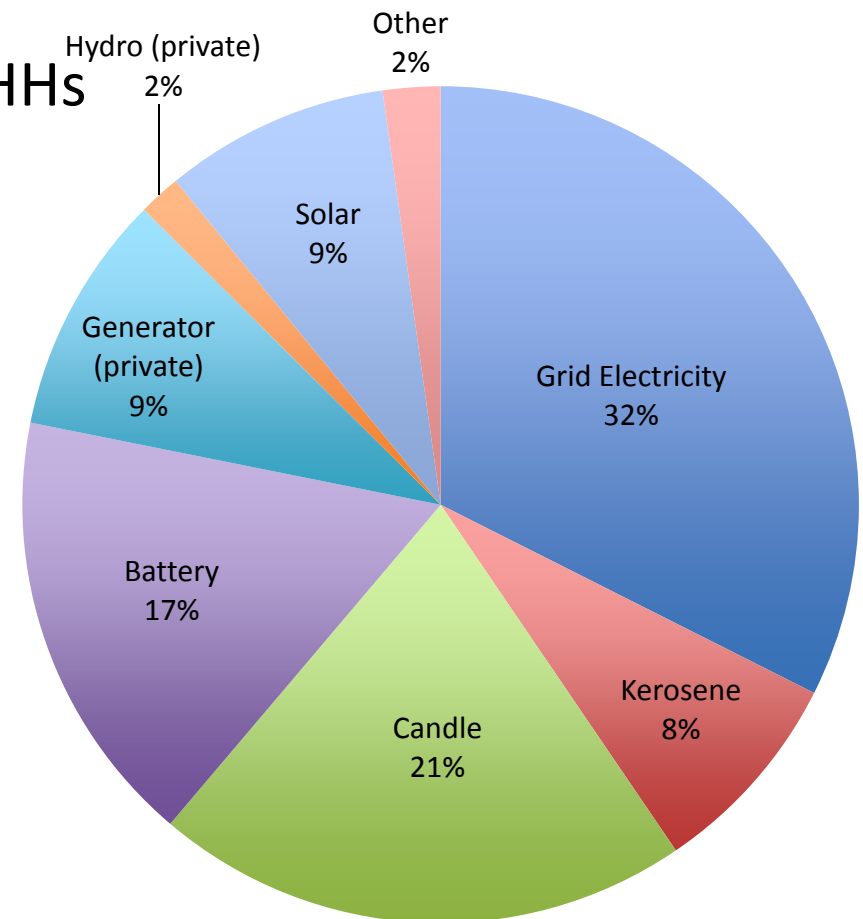
# Summary | Electrification in Myanmar

Large potential market:

- Only 32% grid-connected
- Nearly 5 million un-electrified HHs

	Urban	Rural	Total
Grid Electricity	2,363,403	1,164,314	3,527,717
Kerosene	15,786	860,792	876,578
Candle	218,097	2,033,839	2,251,936
Battery	191,529	1,652,227	1,843,756
Generator (private)	177,309	835,840	1,013,149
Hydro (private)	25,786	151,721	177,507
Solar	42,811	902,431	945,242
Other	14,712	227,235	241,947
<b>Total</b>	<b>3,049,433</b>	<b>7,828,399</b>	<b>10,877,832</b>

Source: 2014 Census



# Summary | Current Solar Market

- Solar is already well-known and widespread
  - Nearly 1 million households
  - Range of products and systems
  - Quality and service is low



# Summary | Potential for High Quality Solar

- The main challenges:
  - Competition from very low-cost, poor quality component-based systems
    - Lack of appropriate end-consumer finance options
  - Large government programs potentially undermining willingness to pay

# Market Geography | Central vs Border Regions

## Central Region:

Commercial market (IFC)

### Ayeyarwady

Bago

Magway

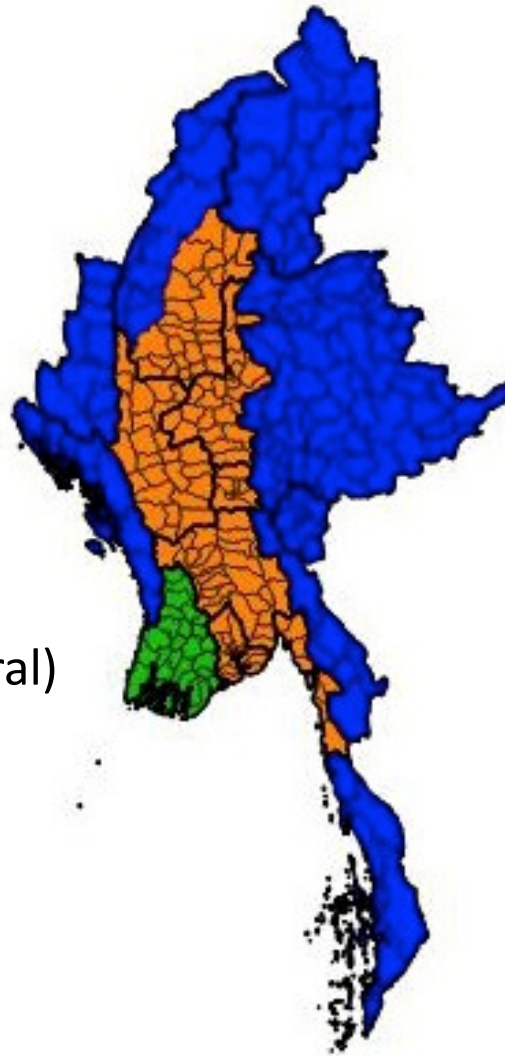
Mandalay

Naypyitaw

Mon

Sagaing (Southeast/Central)

Yangon



## Border States:

Subsidized systems (DRD/WB)

### Ayeyarwady

Chin

Kachin

Kayin

Shan

Rakhine

Tanintharyi

Sagaing (Nagaland/Border)

Kayah (not in NEP)



# Market Geography | Why Central Myanmar?



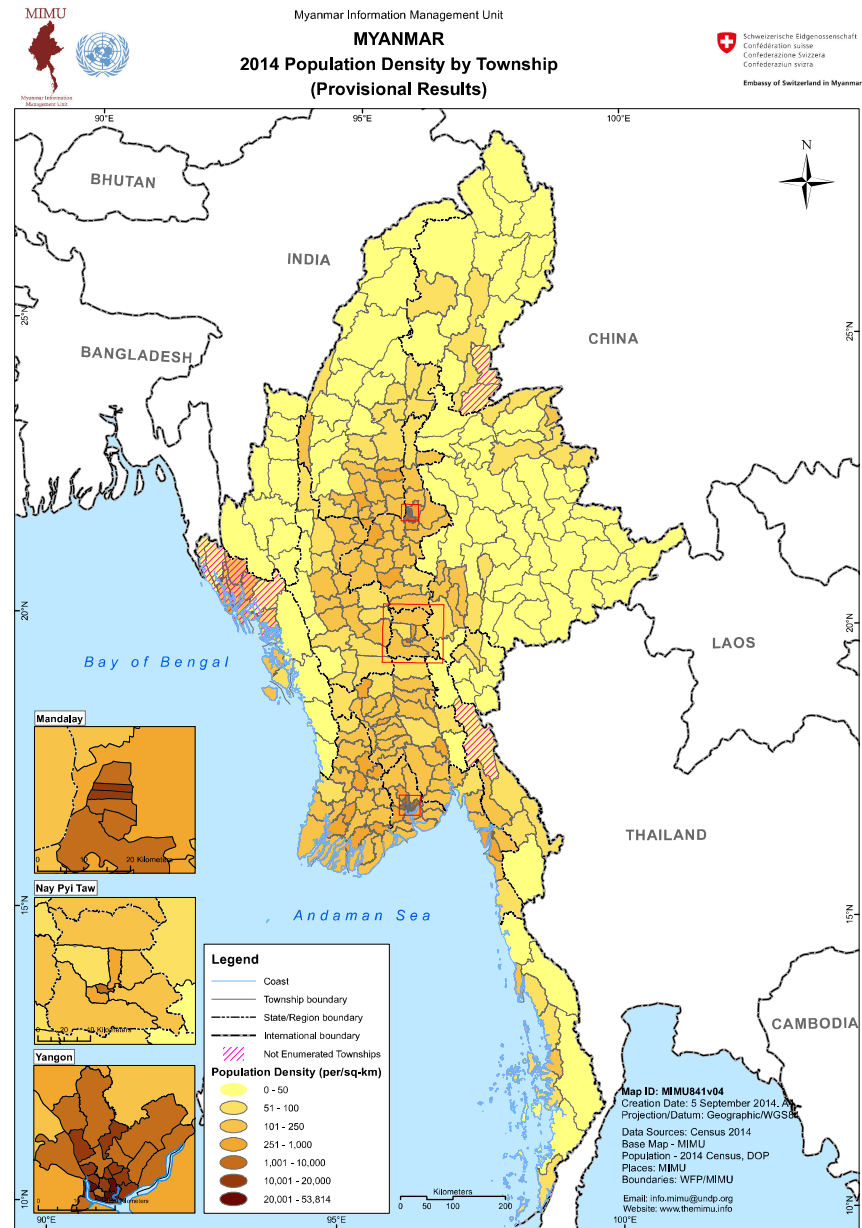
- Large Off-grid Population
- Population Density
- Infrastructure and Accessibility
- MFI Penetration
- Higher Incomes
- Presence of High-Quality Products



# Market Geography | Population Density



Source: MIMU



# Market Geography | Why Central Myanmar?



- Large Off-grid Population
- Population Density
- **Infrastructure and Accessibility**
- MFI Penetration
- Higher Incomes
- Presence of High-Quality Products

# Market Geography | Distribution Infrastructure



Source: JICA National Transport Master Plan



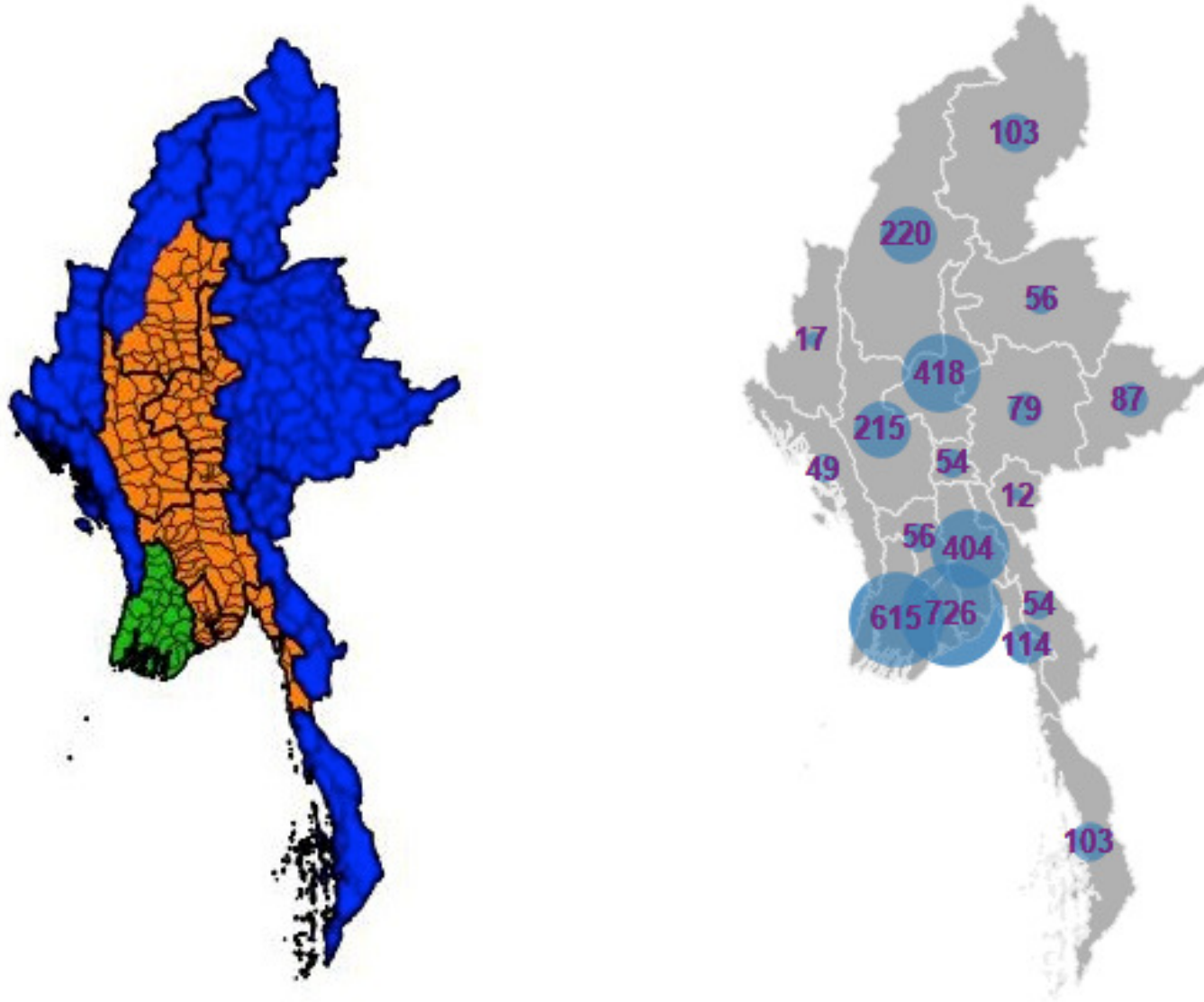
# Market Geography | Why Central Myanmar?



- Large Off-grid Population
- Population Density
- Infrastructure and Accessibility
- **MFI Penetration**
- Higher Incomes
- Presence of High-Quality Products



# Market Geography | MFI Penetration



Source: Microfinance Information Exchange

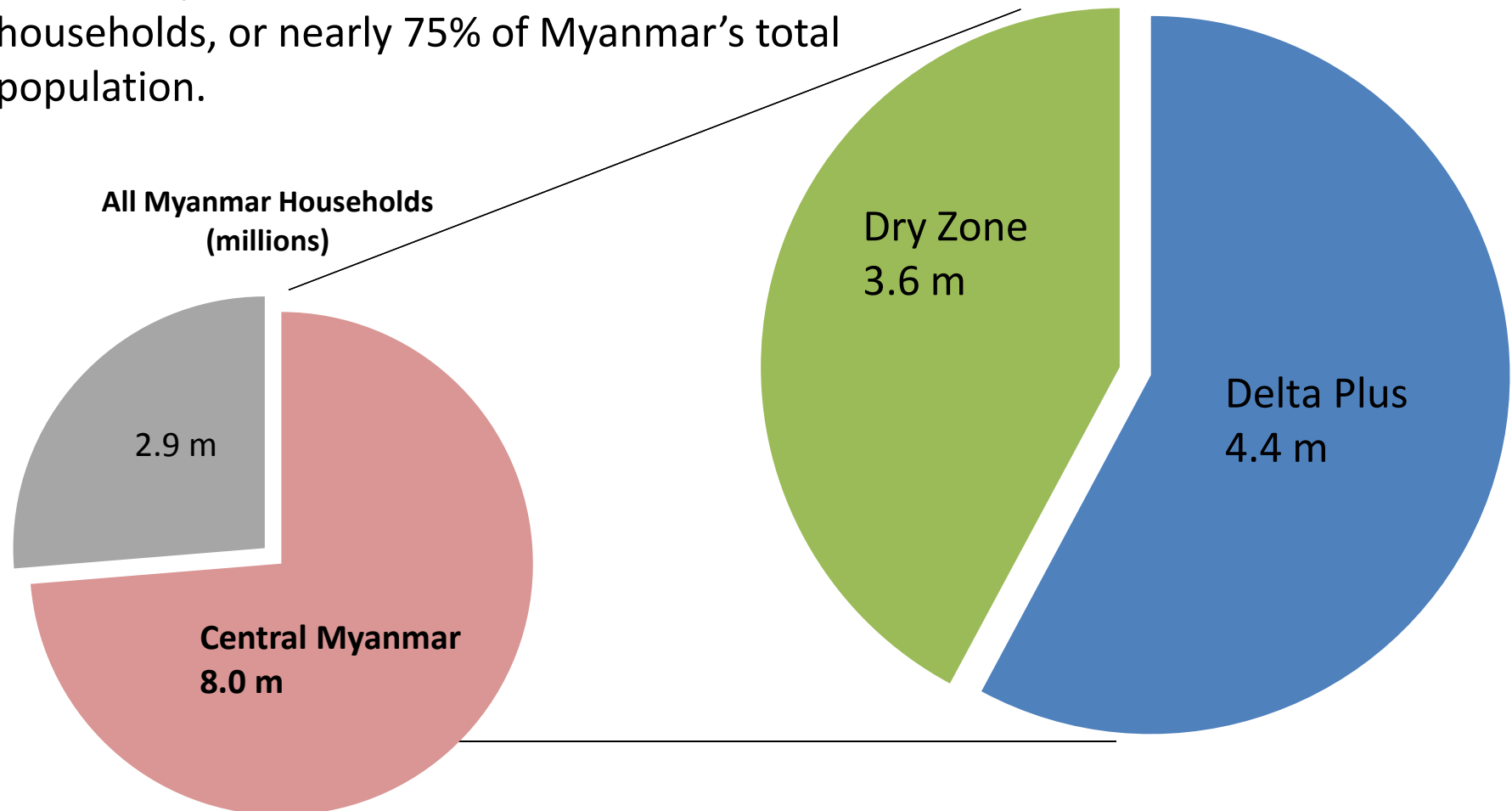
# Market Geography | Why Central Myanmar?



- Large Off-grid Population
- Population Density
- Infrastructure and Accessibility
- MFI Penetration
- **Higher Incomes**
- **Presence of High-Quality Products**

# Market Geography | Population

Central Myanmar contains about 8.0 M households, or nearly 75% of Myanmar's total population.



Source: 2014 Census



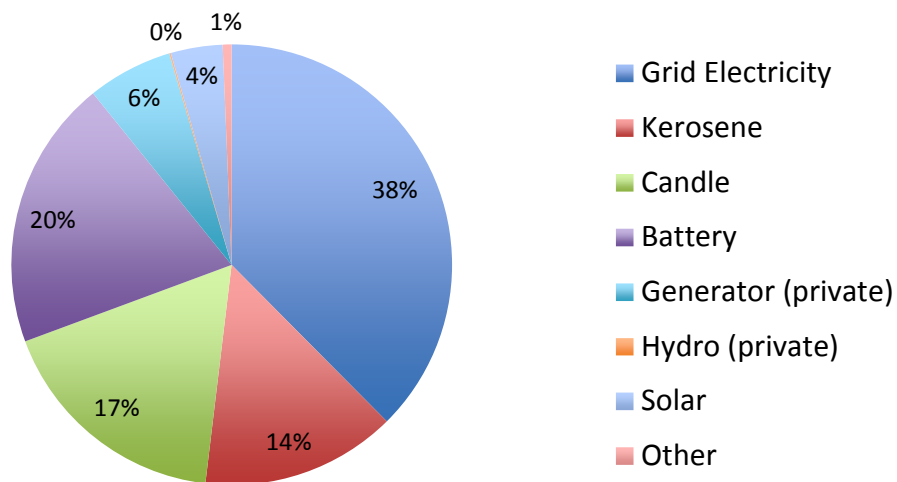
# Market Geography | Delta Plus

## Ayeyarwady, Bago, Yangon, Mon

- 2.9 million off-grid households (2014)
- Centered around Yangon: every major town within 5 hours



Delta Plus – Lighting Supply



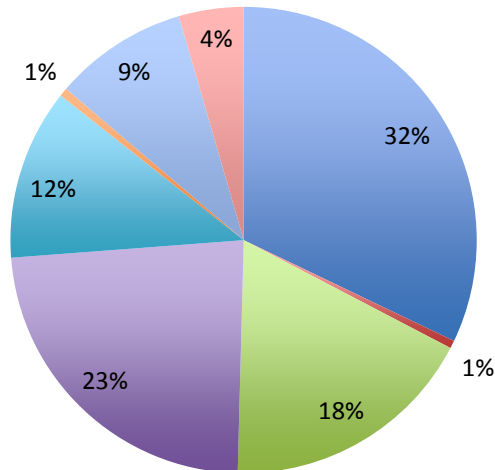
# Market Geography | Dry Zone

## Magway, Mandalay, Naypyitaw, SE Sagaing

- 2.1 million off-grid households (2014)
- Good access to Mandalay city, Chinese border



Dry Zone – Lighting Supply



- Grid Electricity
- Kerosene
- Candle
- Battery
- Generator (private)
- Hydro (private)
- Solar
- Other

# Available Market | Size and Spending

Region/ State	Total Available Market (Households)	Source of lighting							
		Grid Electricity	Kerosene	Candle	Battery	Generator (private)	Hydro (private)	Solar	Other
<b>DELTA PLUS</b>	<b>4,637,513</b>	<b>1,742,923</b>	<b>663,733</b>	<b>809,232</b>	<b>920,112</b>	<b>289,961</b>	<b>5,196</b>	<b>175,655</b>	<b>30,701</b>
AYEYARWADY	1,488,983	178,810	458,988	230,741	457,606	86,943	1,287	66,234	8,374
BAGO	1,142,974	316,091	100,247	329,833	257,303	51,943	1,435	72,962	13,160
MON	422,612	150,876	14,958	134,853	18,314	88,356	1,769	11,383	2,103
YANGON	1,582,944	1,097,146	89,540	113,805	186,889	62,719	705	25,076	7,064
<b>DRY ZONE</b>	<b>3,380,492</b>	<b>1,086,053</b>	<b>18,076</b>	<b>599,760</b>	<b>790,950</b>	<b>399,927</b>	<b>20,479</b>	<b>313,478</b>	<b>151,769</b>
MAGWAY	919,777	208,473	3,491	207,327	246,373	106,178	7,132	93,192	47,611
MANDALAY	1,323,191	520,838	5,949	185,225	296,073	146,520	9,151	107,304	52,131
NAY PYI TAW	262,253	111,678	1,745	81,701	19,391	27,888	554	15,339	3,957
SAGAING (Dry Zone)	875,271	245,064	6,891	125,507	229,113	119,341	3,642	97,643	48,070

Source: 2014 Census

Solar is an option for both sets of consumers **highlighted** above:

Green: Fundamentally **un-served market, 2.1 million households**

Yellow: **Underserved market, 2.4 million households**

**4.5M households with combined monthly spending estimated at US \$18.6M**

# Lighting Supply | Basic Lighting

## Candles

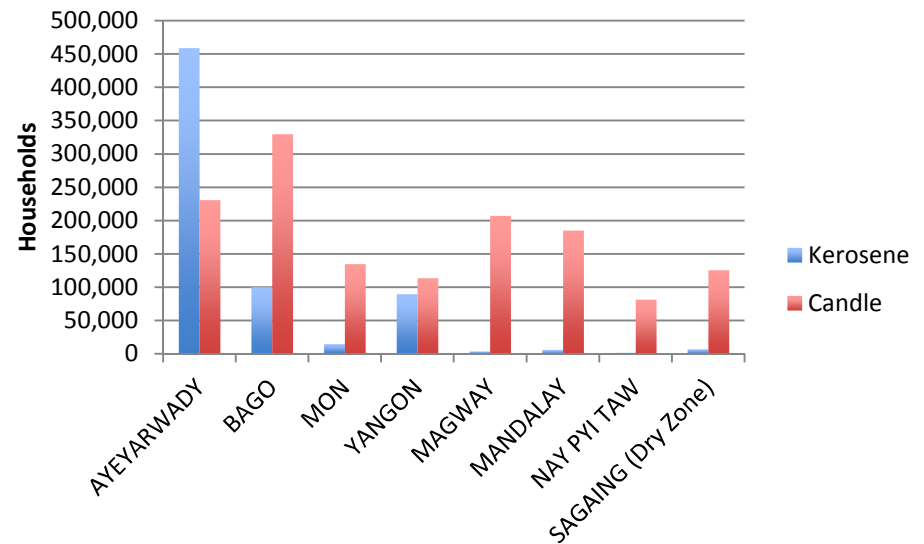
- 100 kyat/candle
- Usage varies widely

## Kerosene

- 200 kyat/day
- Almost exclusively in Delta

## PV Lanterns (light only)

- Short lifespans: 6 months-1 year
- Not popular: customers want phone charging and flexibility
- 4,500-8,000 (\$3.50-\$6.15)



# Lighting Supply | Batteries

- 1.7 million households in Central Myanmar
- Popular brands:
  - Toyo (Myanmar)
  - 3K, GS (Thailand)
- Charging with solar (neighbors/family) for free or at charging station for a fee

Size	Typical Use	Typical Cost
6V	Lighting	3,000 (\$2.30)
12V 8ah	Lighting plus charging	8,000 (\$6.15)
12V 20ah	Lighting plus charging plus TV	20K-30K (\$15-23)





# Lighting Supply | Pico SHS

- Pico SHS available for lighting, phone charging, and TV (in some cases)
  - Panel: 3W-6W
  - Battery: 5AH-7.5AH
  - Cost: 18,000-60,000 kyat (\$14-\$46)
- More common in Dry Zone, but not particularly popular



# Lighting Supply | Component-based SHS

- Strong preference for buying separate components for SHS—Flexibility and Modularity
- Panel prices vary widely on quality
  - 35W: 18K (“Tata”) to 37K (Sandi)
  - 100W: 60K (“Tata”) to 120K (Sandi)
  - 300W: 140K (“Tata”) to 294K (Sandi)

Typical Component-based SHS					
Services	Panel	Battery	Inverter?	Controller?	Cost
Lighting, small EVD	35W	20ah	No	No	50K-60K (\$38-46)
Bigger TV	100W	40ah	Maybe	Maybe	120K-150K (\$92-\$115)
Fridge, rice cooker?	300W	150ah	Yes	Yes	400K-600K (\$300-\$460)



# Lighting Supply | Other Off-Grid

In Central Myanmar, nearly 900,000 households using other off-grid sources:

- Diesel generators
- Gasification (rice husks)
- Micro-hydro (limited)

Typical price structure:

- 100 (<0.10 USD) kyat per light per night
- 100-200 kyat (<0.20 USD) per TV per night

Poor service and high operating costs:

- Generally only a few hours per night
- Many generators shut down after a few years of operation

# Lighting Supply | Grid Electricity

Generally the preferred option

- Lifeline tariff 35 kyat (0.27 USD)/kWh (up to 100 kWh)
- Can power larger appliances (esp. rice cookers)

Limited reliability

- Load shedding and power cuts common

In grid-connected villages, not all HHs connect

- Between 30% and 50% of HHs remain off-grid
- Largely due to cost: service drop (meters, internal wiring) costs 100-150K kyat (75-115 USD), after paying for distribution line extension

# Lighting Supply | Energy-Service Segments

## Basic Lighting

	Up-front Cost	Cost per month	Notes
Candles	N/A	3000-9000 kyat (\$2.30-\$6.90)	100 kyat per candle
Kerosene	N/A	6000-7000 kyat (\$4.60-\$5.40)	Very rare in Dry Zone
Batteries	3000-8000 kyat (\$2.30-\$6.15)	0-6000 kyat (0-\$4.60)	Delta: Pay fee to charge Dry Zone: Charge for free
Solar Lanterns	4000-8500 kyat (\$3.00-\$6.50)	N/A	Not very popular

## Basic Lighting + Phone Charging

	Up-front Cost	Cost per month	Notes
Batteries	8000-20K kyat (\$6.15-\$15)	0-6000 kyat (0-\$4.60)	Delta: Pay fee to charge Dry Zone: Charge for free
Pico SHS	18K-60K kyat (\$14-\$46)	N/A	Not very popular, more common in Dry Zone

# Lighting Supply | Energy-Service Segments

## Lighting + Phone Charging + TV/EVD

	Up-front Cost	Cost per month	Notes
Batteries	20K-30K (\$15-\$23)	0-6000 kyat (0-\$4.60)	Delta: Charge for fee Dry Zone: Charge for free
Solar	50K-150K (\$38-\$115)	N/A	
Generators /Gasifiers	Wide range	9000-60K kyat (\$7-\$46)	100 kyat per light per night, plus 100-150 per TV

## Higher Level Service (e.g. rice cookers)

	Up-front Cost	Cost per month	Notes
Solar	400K-600K (\$300-\$460)	N/A	
Grid Electricity	300-500K (distribution) 100-150K (service drop) (\$300-\$500)	1000-3000 kyat (\$0.77-\$2.30)	35 kyat per kWh <100 kWh  Generally not used for machinery (pumps, threshers)

# Consumer Perceptions | Decision Making

- Price by far the most important factor
  - Very few (~5%?) will choose higher cost/quality brands.
- Longevity not a major concern
  - Batteries/LEDs considered replaceable
  - Panels considered reliable
- Preference for individual components over packaged systems
  - Incremental cost: many consumers will buy a battery first and add a panel later.
  - Replacement cost: easier to replace individual parts than a whole system.

# Consumer Perceptions | High-Quality Solar

- Lighting Only
  - Phone charging is a priority (and available for the same price)
- Lighting + Phone Charging
  - Cheaper alternatives available
- Solar Home Systems
  - Pico systems: Estimates for willingness to pay ranged from 25,000-60,000 kyat (\$19-\$46)
  - Larger systems (with TV): Great interest but uncertainty about price
- PAYG model
  - Some interest from consumers
  - Around 5,000 kyat (\$3.80)/month, if can power TV



# Access to Finance

## Enterprise:

- Large distributors: Good access to finance
- Solar importers/small distributors: Limited to high collateral bank loans
- Retailers: Cash-based

## Consumers:

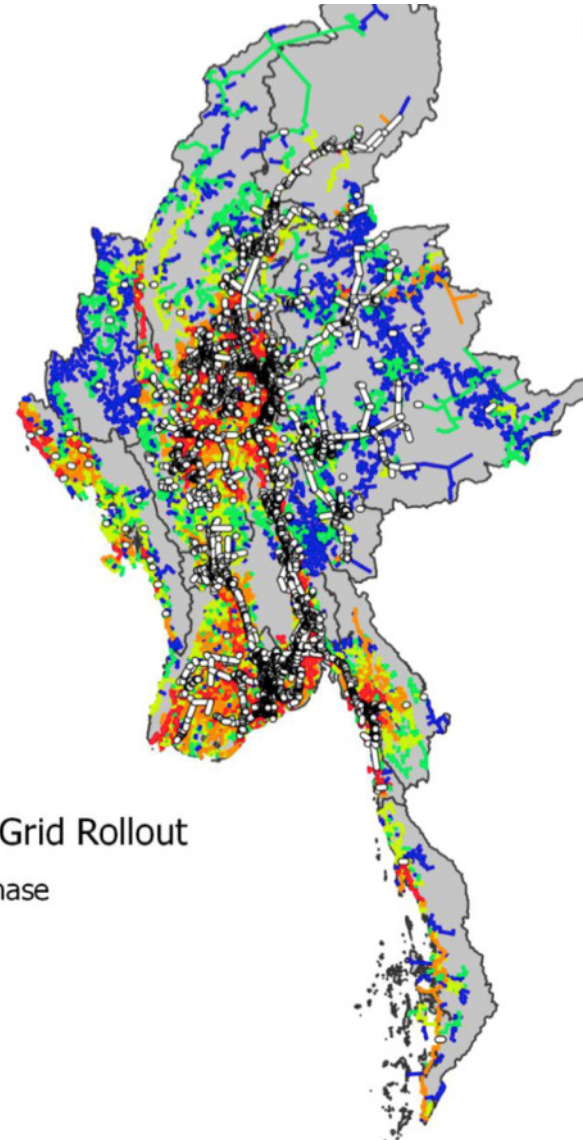
- Almost no consumer financing
- MFIs piloting solar projects, but very small scale
- Mobile money an emerging trend, but still at pilot stage



# Electrification | Grid Extension



- Phased rollout with goal of more than 7 million connections by 2030
- Large potential impact on off-grid market, but manageable



National MV Grid Rollout

Equal MV Per Phase

— Phase 1

— Phase 2

— Phase 3

— Phase 4

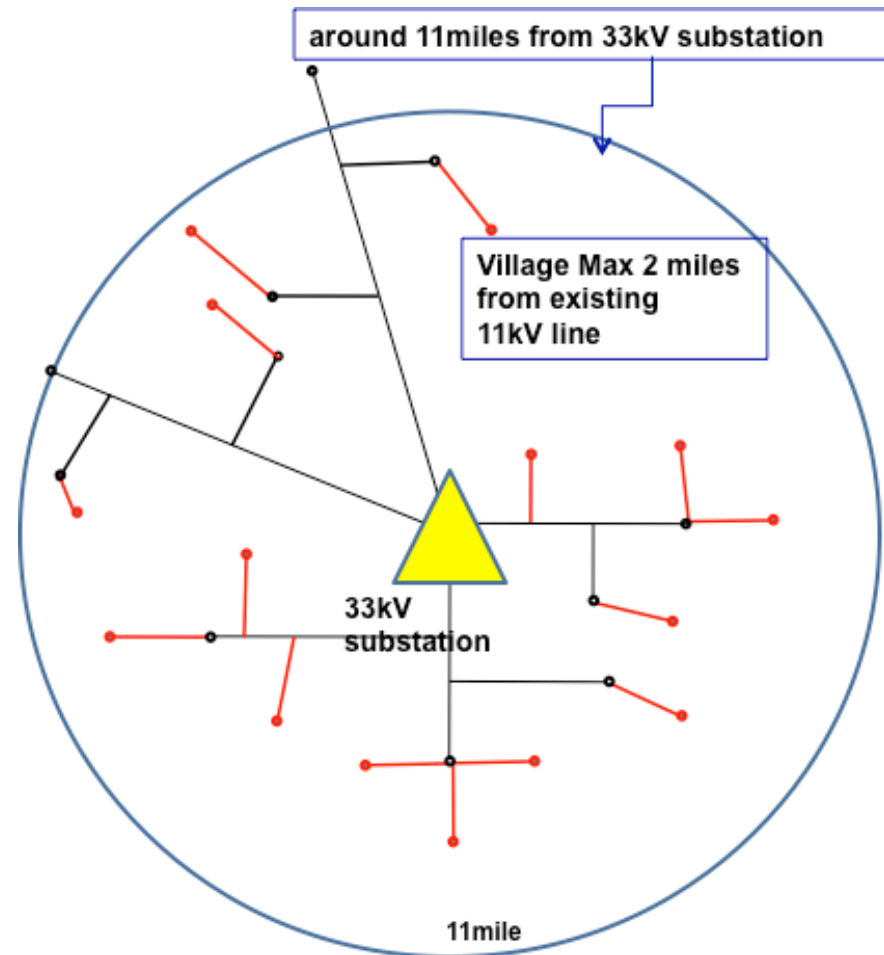
— Phase 5

— Existing MV and HV Substations

# Electrification | Grid Extension



- NEP Stage 1:
  - Within 2 miles of existing 11kV lines
  - Initially no substation upgrades
  - 627,000 HH through roughly 2019
- NEP will pay for distribution lines, household must still pay connection fee



# Electrification | Off-grid



**Old DRD Program:** 100% subsidized SHS; about 350,000 distributed since 2013.

**New NEP Program:** 80-90% Subsidized SHS with higher quality standards and verification.

- Good News: Better solar products in the market, less risk of loss of confidence in the technology.
- Bad News: Effect on willingness to pay

# Electrification | Off-grid



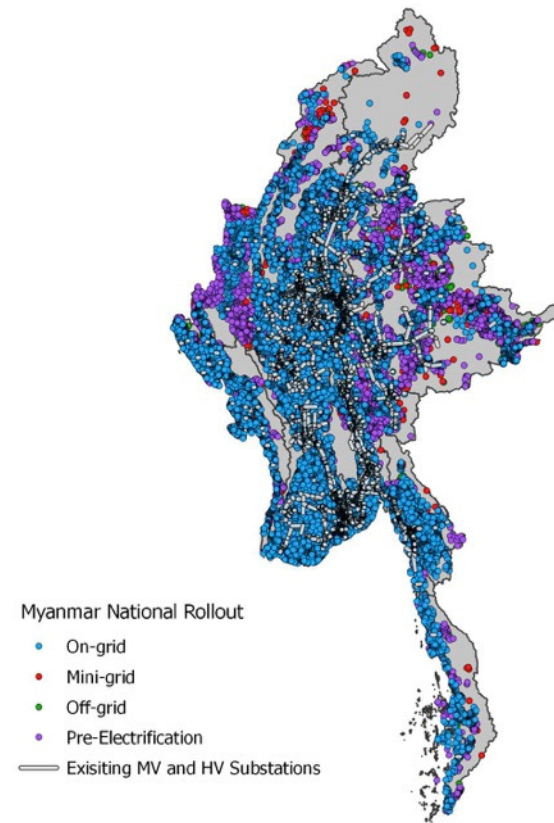
## Some Mitigating Factors:

- Largely limited to remote areas with smaller potential markets
- Good information on specific geography for procurement in Ayeyarwady
- DRD and IFC will continue to coordinate on geographic focus and future program design

# Conclusion | Barriers to High Quality Solar

**Intense Price Competition  
for Similar Service**

**Government Programs  
Targeting Large #s of HHs**



Annex 1

# **Market Geography Additional Details**

# Available Market | Size and Spending

## Unserved & underserved off-grid solar market segments highlighted (green and orange)

Region/ State	Total Available Market (Households)	Source of lighting							
		Grid Electricity	Kerosene	Candle	Battery	Generator (private)	Hydro (private)	Solar	Other
<b>DELTA PLUS</b>	<b>4,637,513</b>	<b>1,742,923</b>	<b>663,733</b>	<b>809,232</b>	<b>920,112</b>	<b>289,961</b>	<b>5,196</b>	<b>175,655</b>	<b>30,701</b>
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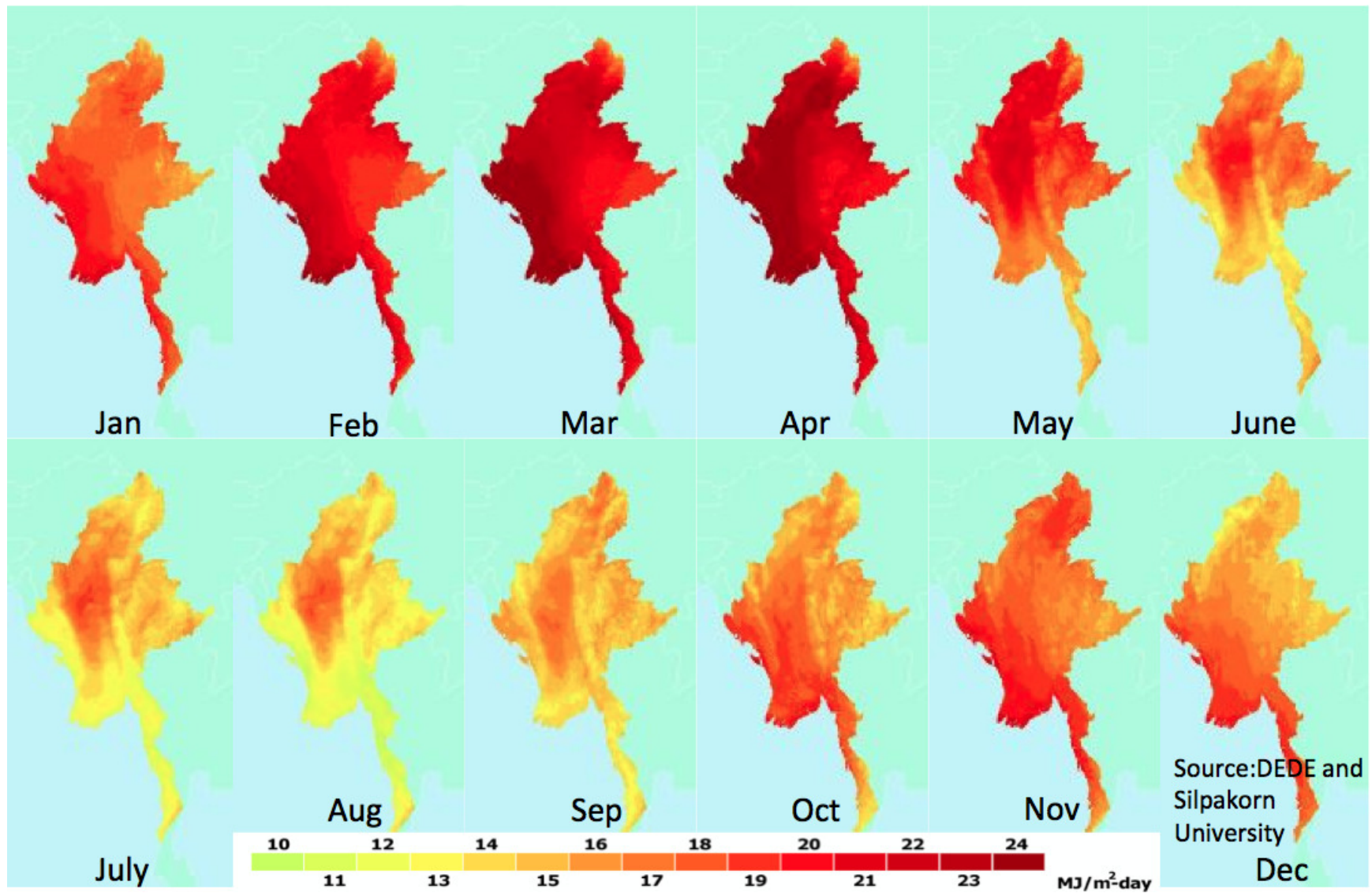
## 4.5M households with combined monthly spend estimated at US \$18.6M

	Monthly Spending by Source of Lighting							
	Kerosene		Candle		Battery		Generator (private)	
	#HH	\$5.00 / mo.	#HH	\$4.62 / mo.	#HH	\$2.31 / mo.	#HH	\$6.92 / mo.
<b>DELTA PLUS</b>	663,733	\$3,318,665	809,232	\$3,734,917	920,112	\$2,123,335	289,961	\$2,007,422
<b>DRY ZONE</b>	18,076	\$90,380	599,760	\$2,768,123	790,950	\$1,825,269	399,927	\$2,768,725
<b>COMBINED</b>	<b>681,809</b>	<b>\$3,409,045</b>	<b>1,408,992</b>	<b>\$6,503,040</b>	<b>1,711,062</b>	<b>\$3,948,605</b>	<b>689,888</b>	<b>\$4,776,148</b>

Source: 2014 Census



# Monthly Insolation



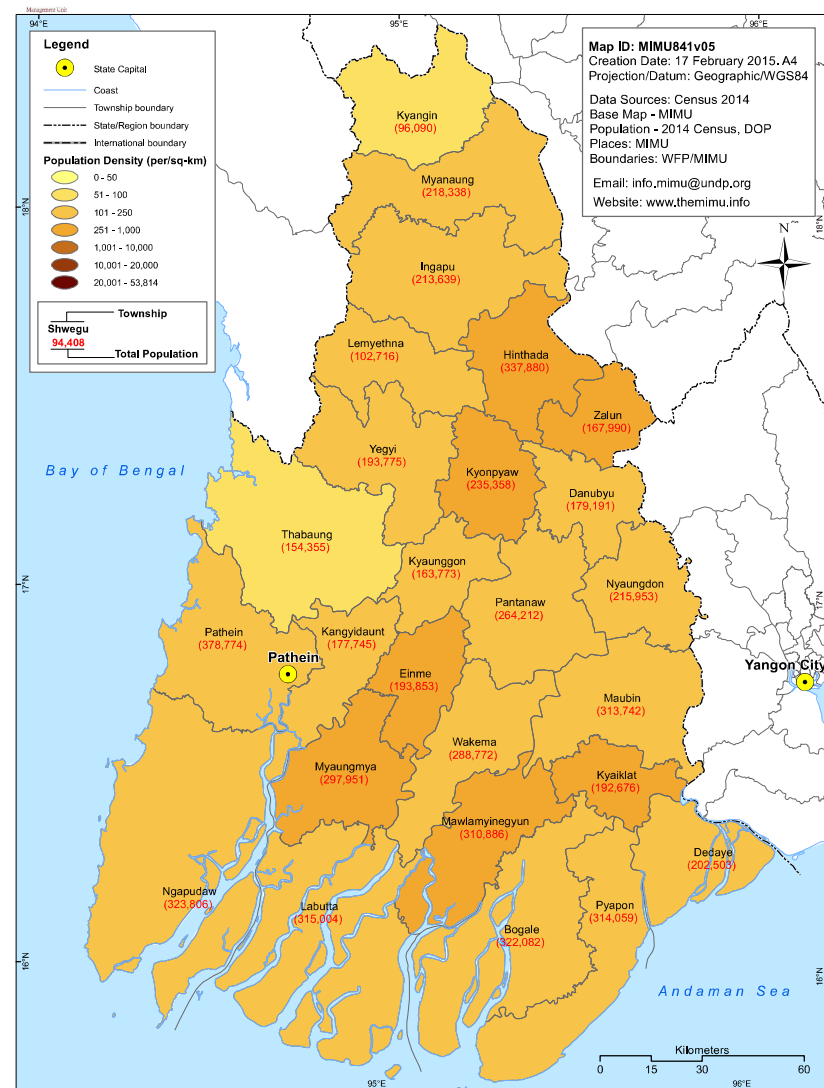
# Solar Penetration

- Highest rates in Shan State, near Chinese border



# Ayeyarwady

- 2<sup>nd</sup> largest state/region
- Largest off-grid population (1.3 million)
- Accessibility to Yangon
- Large microfinance presence
- Quality products already present
  - d.light (Proximity)
  - Greenlight Planet (Total)



# Regulatory Issues

- Subsidies
  - Removed on fuel in 2007
  - Electricity: residential lifeline tariff of 35 kyat (\$0.03)/kWh (though actual rate charged varies in rural areas)
- Import Tariffs
  - Waived on solar components (panels, inverters, etc.)
  - Kits, lanterns not specified; in practice may waive some fee, based on estimated cost of “solar” components
  - Rates:
    - LED Lamps: 1%
    - Batteries (not to exceed 200Ah): 2%
    - Electrical goods: 7.5%
  - Total tariffs+fees 10%+, depending on batch size

# Distribution | Existing Off-Grid Products



**Panels:** From China,  
via Mandalay

**Batteries:** From  
Thailand, via Yangon  
(or domestic)



## Distribution | Other Networks

**Agriculture:** Two main distributors, Awba and CDSG, both have extensive networks and strong rural presence.



**FMCG:** CDSG, DKSH, Myanmar Distribution Group, and several others distributing throughout the country.



**Pharma:** AA Marketing is an industry leader, and is already importing and distributing IFC-certified products through its partnership with Total.



Annex 2

# **National Electrification Plan**

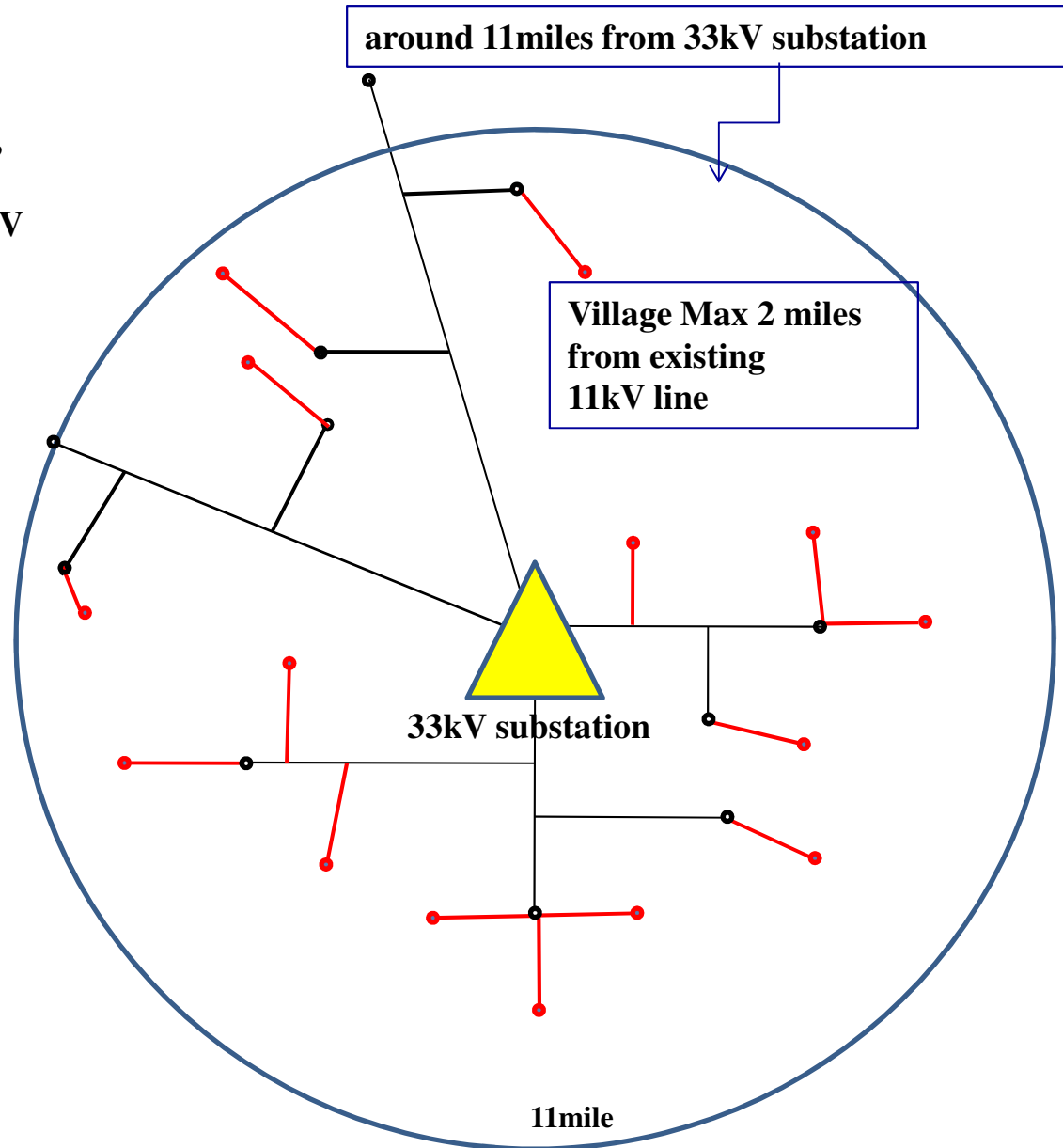
# NEP Stage-1 electrification 2 miles

## Phase1 – Simple MV works”

- ✓ Within 2 miles of existing MV line,
- ✓ No S/S reinforcement
- ✓ Not further than 11miles from 33kV substation

## Phase2 – Substation Reinforement”

- ✓ As phase 1 but requiring S/S reinforcement





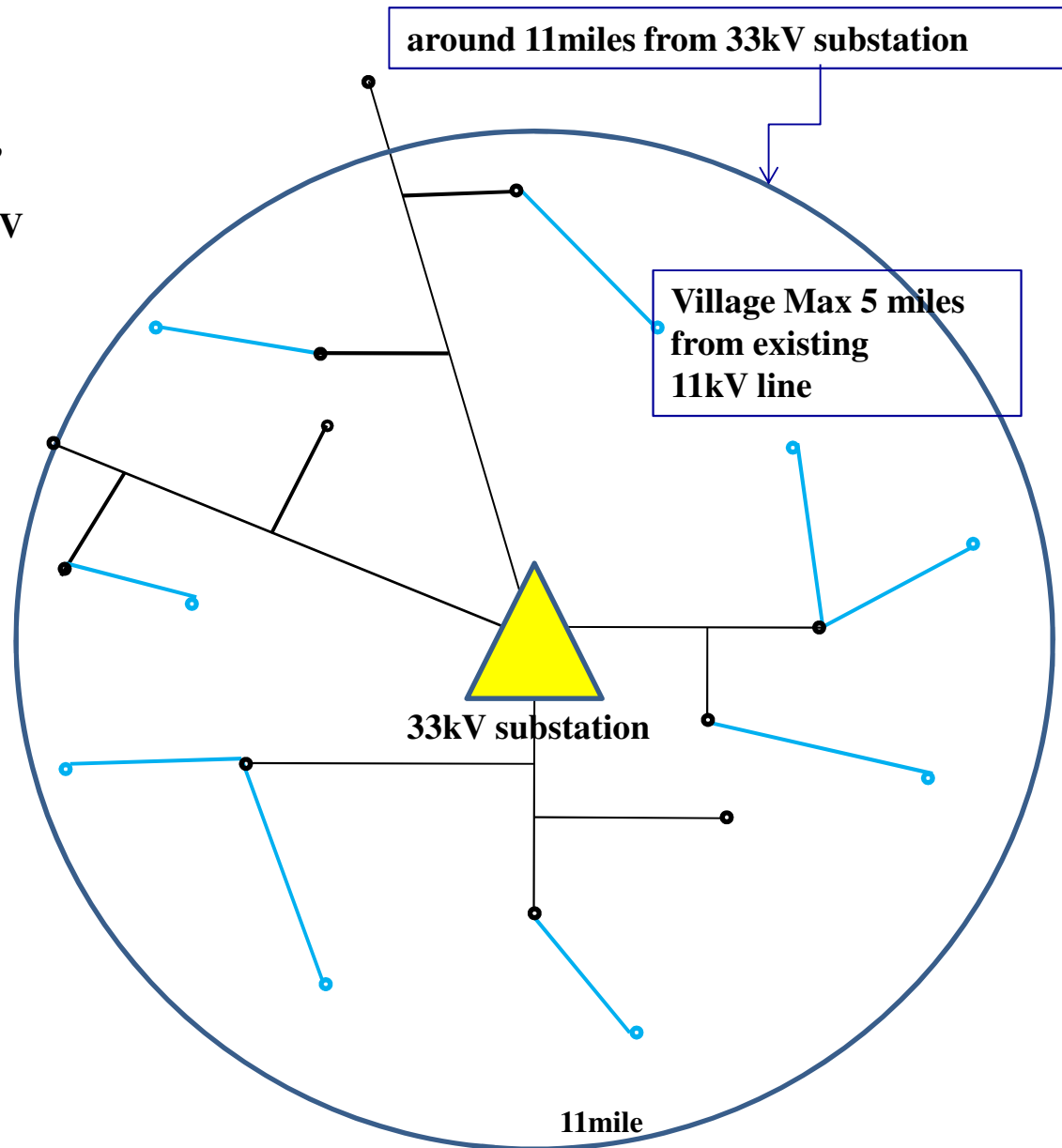
# NEP Stage-2 electrification 5 miles

## Phase1 – Simple 5 mile MV works”

- ✓ Within 5 miles of existing MV line,
- ✓ No S/S reinforcement
- ✓ Not further than 11miles from 33kV substation

## Phase2 – Substation Reinforcement”

- ✓ As phase 1 but requiring S/S reinforcement of 63/33 and or 33/11kV



# NEP Stage-3 New 33kV substations

Stage 3- Electrify villages requiring new 33kV substations with associated 11kV lines

